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Spore-dissemination of Equisetum.[1]

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(WITH PLATE IX.)

The subject of spore-dissemination of Equisetum may be considered under three heads:

I. Elongation of the axis of the spike.

II. Structure of the sporangium-wall and its mode of dehiscence.

III. Structure and action of the elaters.

Unless otherwise stated, these notes are wholly on Equisetum arvense preserved in alcohol.

I. *Elongation of the axis of the spike.*—In the immature spike the peltate scales which bear the sporangia on their inner surfaces are closely united edge to edge, forming an unbroken wall; but as the spores are nearing maturity the axis of the spike and the stalks of the peltate scales rapidly elongate, causing each scale to become separated by a considerable space from its neighbors. By careful comparison of cellular structure, this elongation seemed to be due to increase in length of cells. Longitudinal sections from the axis and scale-stalks of several spikes in which the scales were about to separate were made, and similar sections from the corresponding parts of spikes with separated scales. In each comparison the difference in length of cells was easily perceptible, the cells of the fundamental tissue in the different axes giving as the result of many measurements of length the ratio of 3 to 4. Thus, by the separation of the scales, resulting in the drying of sporangium-wall and spores, and furnishing a means of escape for the spores after they have left the sporangium, the first step in spore-dissemination is accomplished.

II. *Structure of the sporangium-wall and its mode of dehiscence.*—Each of the numerous scales of the spike is attached by a stalk running from the center of the scale to the main axis. Around the stalk and attached to the scale are from five to ten sporangia, arranged in a single row. A

[1]Contribution from the botanical laboratory of the University of Michigan.

sporangium is shaped like the finger of a glove. The dehiscence extends the whole length of the sporangium, and is always along the surface which is directed toward the stalk of the scale.

Examined with the microscope, the sporangium-wall is seen to be composed of several layers of cells. The attention is first caught by the appearance of the external layer of cells. These are found to have a definite arrangement, as indicated diagramatically in fig. 1. For convenience the surface of the sporangium which is nearest the stalk may be designated as the inner or ventral, and the opposite one as the outer or dorsal surface. Along the ventral surface are sometimes three, sometimes four, rows of cells, with their long axes at right angles to the long axis of the sporangium. Passing outward on each side from these rows of transverse cells the other cells of the external layer of the wall become more and more oblique, till on the dorsal surface they correspond in direction with the long axis of the sporangium.

In the three or four rows of transverse cells of the sporangium-wall, usually one row is of shorter cells than those composing the other rows, and the cells of this row are strengthened by rings. The transverse cells of the adjoining rows are marked by both rings and spirals; and the oblique and longitudinal cells are spiral, an annular cell being very rarely found among them (fig. 4). In Equisetum hyemale, however, though the transverse cells are mostly marked with rings, the other cells, without definite arrangement, are some annular and some spiral.

In addition to this outside layer of cells, the sporangium-wall contains two or three other layers of cells, not so conspicuous as the annular and spiral cells just described, but none the less constant. The sporangium-wall has been described by authors as composed of a single layer of cells. In Equisetum arvense and hyemale this is certainly not the case. These inner or lining cells have probably escaped notice because of the difficulty in detecting them by looking down upon or through the sporangium-wall. If sections of the sporangium be examined, the inner layers of cells become clearly visible. In working out this structure, groups of sporangia of Equisetum arvense were carefully imbedded in paraffin, and both longitudinal and transverse sections made on the rocking microtome. On examination, the tissue was found to have been injured in no way by the process of imbedding. Fig. 5 is a portion of a longitudinal section of a sporangium

with a part of the peltate scale and of the stalk: *a*, portion of the scale-stalk; *b*, section of the transverse cells of the ventral wall of the sporangium; *c*, section of the dorsal wall of the sporangium; below the sporangium is the scale in which the fibro-vascular bundle is seen to end. The spiral cells of the dorsal surface are continuous with the epidermal cells of the scale. Occasionally a spiral or annular celi is found in this epidermis. Fig. 6 is a transverse section of a sporangium-wall, midway between base and apex. In three positions—one dorsal and the other two lateral—the wall is strengthened not only by an increase in size of the spiral cells, but also by a greater number of the inner or lining cells. As we approach the region of the ventral transverse cells, the sporangium-wall becomes thinner and thinner by the decrease in number and size of the lining cells. Sometimes—as shown in fig. 6 at *a*—the lining cells can be seen to be continued across the external transverse cells; but here the inner cells are always reduced to a single very thin layer. Usually this layer of lining cells disappears in the ventral region; for it becomes closely appressed to the transverse cells. From the base to the apex of the sporangium, the lining cells are never more than one layer thick in the region of dehiscence, while dorsally and laterally these cells are three layers thick at the base and two layers thick at the apex.

Sablou[2] found that the length of the moist spiral cell was to that of the same cell when dry as 20 to 14, while the width is imperceptibly lessened.

In alcoholic material the relative length of the cell when moist and when dry is, with slight variation, as 2 to 1; the relative width, as 4 to 3. From the arrangement of the external cells of the wall, it is evident that the sporangium will contract in length much more along the dorsal than along the ventral surface. In fig. 3 the position of the line of dehiscence in the moist sporangium is indicated by an unbroken line. From what we know concerning the arrangement of the external cells and their contraction, we should expect, in drying, one edge of the wall along the line of dehiscence to move to the position indicated in fig. 3 by a dotted line—this line moving, as it passes from the base, more and more from its original position. And this is exactly what happens, as shown by fig. 2, which gives the appearance of an open sporangium.

[2] Annales des Science, 7 Series, Tome 2.

The act of dehiscence of the sporangium was observed in six cases. The rupture begins near the apex, a little toward the ventral surface. The opening is at first irregular, with radiating lines extending between surrounding cells; but soon the dehiscence takes a definite direction between two rows of transverse cells—this being the place where the wall is thinnest, and the line between adjacent rows of external cells straightest. The line of dehiscence in its descent to the base frequently passes from one side of a row of transverse cells to the other side. Near the apex especially the dehiscence is usually quite irregular, as shown in fig. 2.

What is the function of the transverse cells? It can not be merely to pull the wall apart; this is accomplished in a greater degree by the oblique and longitudinal cells. The transverse cells prevent the ventral wall of the sporangium from shortening equally with the dorsal wall—thus assisting in dehiscence and causing the edges of the open sporangium to gape widely.

III. *Structure and action of the elaters.*—The external coat of the spore divides at maturity into four narrow, spiral bands—the so-called elaters—as shown in fig. 7. If the spore be allowed to dry, or if it be immersed in glycerine, the elaters will unwind as shown in fig. 8, remaining attached to the spore at one point. If in fig. 7 we call the positions of the expanded ends of the elaters the poles of the spore, then the elaters are attached to the spore at the equator. When the elaters are outstretched they may, as stated by Sachs, assume the form of a cross; but they do not cross one another. Often, in straightening out, the elaters become detached from the spore. If one such detached elater be examined, there will frequently be found, about half-way from end to end, a very thin bit of membrane attached by one edge to the elater (fig. 8). This piece of membrane has the appearance of having been peeled off the surface of the spore.

To account for the hygroscopic movements of the spores, the elaters have been described by Sablou as composed of two layers—an external cellulose layer, and an internal layer of lignine. Two layers may be demonstrated both mechanically and chemically. If pressure be exerted on the cover-glass so as to crush the spores underneath, some of the elaters will be found in the condition shown in fig. 10. Here there is an evident separation between the two layers. If spores be placed in Schultze's solution or in picrocarmine,

the two layers of the elater are differently stained. The outer layer is probably cellulose and the inner lignine, as stated by Sablou. In Schultze's solution the outer layer does not seem to give a characteristic cellulose reaction; the inner layer is stained yellowish brown. In iodine solution, with subsequent addition of sulphuric acid, the outer layer of the elater shows, after an hour or two, a decidedly blue color.

Perhaps the most noticeable feature of the minute structure of the elaters is the striation of the cellulose layer, distinguishable without the use of reagents, but made a little more distinct by the application of caustic potash. Everything seems to indicate that the cellulose layer is built up of oblique laminæ, separated by much thinner plates of a substance of different refractive power. If an elater lies in a position vertical to the view, with either its external or lateral surface toward the observer, the direction of the laminæ is from left to right downward (figs. 10–11). That these are really laminæ is proved by their tendency to separate under pressure instead of breaking across (fig. 11). By actual measurement, these laminæ are found to be thinner when dry than when moist. The result of such shrinking is the unwinding of the elaters, provided that the shrinkage is less in the inner layer. A cross-section of an elater gives the form indicated in fig. 12.

RECAPITULATION: I. The first step in spore-dissemination is the separation of the sporangia-bearing scales by the elongation of the axis of the spike, thus allowing free circulation of air for drying spores and sporangia, and providing open spaces for the escape of the spores after dehiscence of the dry sporangia.

II. The comparatively straight columns or rows of transverse cells in the ventral wall of the sporangium, together with the thinning out of the wall in this region, furnishes a line of weakness which becomes the line of dehiscence. Moreover, the unequal contraction in length and width of the strong external layer of cells of the sporangium-wall results in a great shortening of the dorsal wall and a slight shortening of the ventral wall, thus causing a wide opening in the ruptured sporangium for the passage of the spores.

The hygroscopic properties of the elaters seem to be satisfactorily explained by the difference in chemical composition of the two layers composing them.

The function of the elaters is twofold: (1) to push the

spores out of the sporangia; (2) to furnish sails for catching the wind by which the spores are distributed.

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EXPLANATION OF PLATE IX.—Fig. 1. Sporangium of Equisetum arvense, × 80. This figure is diagrammatic; but the cells are represented in true position and size; *a*, probable line of dehiscence; on each side of this line are the transverse cells; at the left are the longitudinal cells of the dorsal wall; and between transverse and longitudinal cells are the oblique cells.

Fig. 2. Sporangium of E. arvense after dehiscence, × 30.

Fig. 3. Diagram of a sporangium of E. arvense, × 30. The unbroken median line shows the position of the line of dehiscence before rupture; the dotted line shows the relative amount of shortening of the dorsal and ventral surfaces of the dry sporangium. The dotted line would also represent one border of the gape into the ruptured sporangium.

Fig. 4. Portion of the wall of E. arvense, to show cells in the region of the line of dehiscence, × 175. Here are three rows of transverse cells containing rings and spirals.

Fig. 5. Longitudinal section of the lower part of a sporangium of E. arvense, with a portion of the scale and scale stalk, × 125: *a*, cells of the scale stalk; *b*, section of the ventral transverse cells of the sporangium-wall; *c*, section of the dorsal wall of the sporangium. Below the cavity of the sporangium is a portion of the peltate scale.

Fig. 6. Transverse section of a sporangium of E. arvense, midway between base and apex, × 125: *a*, probable location of the line of dehiscence.

Fig. 7. Spore of E. arvense, with the elaters beginning to unwind, × 350.

Fig. 8. Same with elaters outstretched, × 350.

Fig. 9. One of the elaters of the same, showing triangular membrane at the place of attachment, × 350.

Fig. 10. Portion of an elater of the same, showing separation of cellulose from the inner layer, × 700.

Fig. 11. Expanded end of an elater of E. arvense, showing a split between the laminæ, × 700.

Fig. 12. Cross-section of an elater of the same, × 700.

Personal reminiscences of Dr. Asa Gray.[1]

C. V. RILEY.

The greatest of America's botanists, Asa Gray, will nevertheless be remembered for many other qualities. He was essentially a self-made man, and rose to preëminence through his own good qualities of heart and head, coupled with enthusiasm and perseverance. There was nothing stilted or

[1] Remarks made at the Gray memorial meeting, held by the Biological Society of Washington, April 5, 1888.

self-contained about Gray, no congealing atmosphere surrounding him. He was one of the people, and few men, in dying, have had more sincere mourners.

Doing an immense deal of what Prof. Lesley has so fitly characterized as "dead work" in science, he yet found time not only to popularize his favorite study, but to deal pointedly with such broad and philosophic questions as grew out of the vast structure of fact which he so zealously helped to build. Where so much pure systematic work was accomplished, and so much more planned, it is no easy matter (as some of us realize but too well) to rise above the vast detail and lay such a broad educational foundation as this master did.

Gray took a medical course, but can not be said to have had a classical education; yet no man wrote more pleasingly or with more grace and accuracy, and we can all indorse Sir Joseph Hooker's words when he says, in a late able notice, that "How Plants Grow" and "How Plants Behave" for charm of matter and style have no equal in botanical literature, and rival chapters in Kirby and Spence's Introduction to Entomology.

It seems almost a work of supererogation to endeavor to convey any personal reminiscences of one who was so familiar a figure to so many of those gathered together here to do honor to his memory. My own personal relations with him can but reflect those of hundreds of Washingtonians. They grew out of the impulse which had been given to the subject of the interrelation between insects and plants some two decades since—an impulse which his own charming writings did so much to quicken. I shall never forget the keen interest and relish he displayed in the first paper read before the American Association for the Advancement of Science at Dubuque in 1872, on the Pollination of Yucca by Pronuba. Those present on that occasion will remember with what joy he hailed such a unique case of direct interdependence between a plant and an animal. I have had the privilege of his hospitality at Cambridge, and have spent some joyful hours with him in travel and in camp; but, whether around his own hospitable table, amid the refinement of his home life, or in the herbarium or the experimental gardens surrounding it; whether amid the whirl of travel, or in the quieter enjoyment of camp life on Veta Pass, I have always experienced exceptional inspiration, delight and instruction in the communion. True to his name in color of cloth and

hair, his gray, spare and active form ever conveyed a sense of untiring energy both of mind and body. His unflagging industry and cheeriness, together with an undercurrent of humor—which could no more verge on the gross or profane than the dove could imitate the vulture—made him the life of any party, and I well remember, during the memorable Gray-Hooker excursion in the west, how Sir Joseph and the other English members of the party never ceased to marvel at his unceasing alertness. It was, indeed, difficult to realize Gray's age because of this activity, and at a time in life when men are ordinarily bowed with the weight of years—when the machinery gets out of order and refuses to run smoothly—he could outwalk and outwork most of us. His bright intelligence, genial disposition and charming personality, which, as Hooker remarks, gave him the entré to *salons* as well as to the museums of every capital, upon his first visit to Europe, just half a century since, continued through the mellowing influences of age.

One day last October I was dining with a friend in the magnificent new building on the bank of the Thames of the National Liberal Club of Great Britain. The conversation naturally turned on Gladstone: "How does he act and appear," I asked, "when he is among you at the club?" "Oh," my friend replied, "he so entirely throws off his age in animation that he would be one of the youngest of us if we gave him a chance to be; but he sheds such an atmosphere on the few occasions when he visits us, and the members crowd around him so eager to hear his voice and to pay him homage, that he never gets the chance."

Gray had something of this same magnetism, and similarly influenced the younger generation of naturalists on all public occasions. In all my personal recollections of Gray, however, he is indelibly associated with one who must have wielded a most beneficent influence over him. I can not think of them apart. She, his boon companion, with whom we so sincerely condole in her widowed bereavement, was always and everywhere by him. I do not know how much or how little she quietly helped him in his botanical work; but I know that no wife was ever more sympathetic with her husband's efforts, more tender, true and solicitous, than the sweet-faced, lovable and loving woman who is so essentially linked with our recollections of the man. The implicit trust and confidence with which he would appeal to her on all occasions, and the manner in which toward the end he would

depend on her quicker ear and keener eye, were beautiful to behold.

Few men have taken more active part in the discussions of the day, or acted more constantly or prominently as critic and reviewer. Yet, while he could be severe in private, his public censure or blame was tempered not only by consideration, but by the conspicuous justness and soberness of his views. So it came about that he retained the esteem of those he most often condemned. One striking illustration of this trait, within my knowledge, may be referred to. Few men were more often reproved by him than a whole-souled friend of mine who has done much for horticulture and botany, but has, withal (as who of us has not?), sometimes been wrong both in observation and conclusion. Shortly after Darwin's death, a leading natural history magazine published an extremely unjust and personal paragraph about the gentleman referred to, pretending to quote Darwin's opinion. Though he had done much to promote the monthly referred to, Gray was thoroughly incensed at the spirit of the paragraph, and never afterward had the old sympathy with the magazine.

Transcending almost in importance even the influence of his botanical and intellectual work proper, I hold to be the value of the lesson of his simple, stainless life. Hooker points out the great similarity in the lives of Gray and the elder De Candolle. In the purity of his character, in the affability of his manner, in the breadth of his mind, and the democratic approachability of the man, if I may so express it, I can not help coupling his, in thought, with that other great mind which but lately ceased to work, and but lately we met to honor. Spencer F. Baird and Asa Gray had much in common besides the influence which both exerted on natural science.

Gray's private correspondence must have been immense. His hand-writing was rather on the sprawly order, indicative of hurry and pressure, and in this, together with the tendency to abbreviate and the frequent omission or malformation of a letter, recalls that of the illustrious Darwin. The style of his correspondence was pointed, clear and happy, and often spiced with bits of humor—in short, like the man.

The last time I met Dr. Gray was in September of last year during the meeting of the British Association for the Advancement of Science, at Manchester. He had been in Europe for some time, and, as on previous visits, had been everywhere honored, and those Americans in attendance

were glad to find him very much the same active, cheerful spirit as of old. Yet in conversation and upon closer contact a diminution of vigor, a diminished brightness of the eye, and a greater tendency to lean on Mrs. Gray, were noticeable. He was naturally more often in section D (biology) than in the other sections, and frequently on the platform. The reading of the annual address by Prof. Alfred Newton, the president of the section, was an occasion of exceptional interest. Seated upon the platform were many eminent biologists from all countries, but the mention of the name of none of them called forth such universal marks of sympathy and applause as that of our beloved Gray. The occasion was inspiring to an evolutionist because President Newton devoted a large portion of his address to the then unpublished "Life and Letters" of Darwin, the proofs of which he had been allowed to see in advance. Tenderly and sympathetically he dwelt on the charm and the noble character of the man, aside from his work, showing clearly that,

"Whatever record leap to light,
He never shall be shamed."

He laid emphasis on the fact that in that year of British jubilee there was a fitness in the theme, because it was exactly the fiftieth anniversary of Darwin's first conception of his main theory, as shown by an entry in his pocket-book for the year 1837. He alluded most touchingly and feelingly to Gray's part in helping to diffuse and promulgate Darwinism, as clearly brought out in the "Life and Letters," and particularly to the early correspondence with Gray, and the letter of September, 1857, in which was clearly sketched the general outline of the theory of natural selection, and which was so important in establishing the relative claims to priority of discovery of Darwin and Wallace. The very marked and fervid expression of admiration manifested by the audience as Prof. Newton, in this part of his address, faced Dr. Gray, was certainly most gratifying to every American present; and when at the close of the address there was a spontaneous call for the eminent botanist, words can not depict either the emotion of Gray himself or of the audience, as it breathlessly listened to his few words. His voice was weaker than I had ever known it, and so low, indeed, as to be at times unheard in the rear of the hall. In supplementing Newton's feeling contribution to the memory of Darwin, he spoke of natural selection as a thing so self-evident that it no longer needed argument; that, at the same time, it had

little to do with the cause or causes of variation. He intimated that botanists were formulating some new conceptions, but did not indicate what these might be.

Now, I have no idea that Prof. Ward will have left anything unsaid in reference to Gray and Darwinism, for no one is more competent to handle the subject fully and thoroughly; and if I venture, in closing, on a few thoughts which naturally grow out of this my last meeting with Dr. Gray, it is with a feeling that perhaps my able predecessor may not do full justice to the design side of the question.

The opening of our civil war witnessed the beginning of a discussion which, in its effects on the thought and civilization of the future, will be as far-reaching as the contest which eventually led to the abolition of slavery in our land. From the time of the appearance of the "Origin of Species" Gray fought for and Agassiz against the theory of natural selection and of the derivation of species from pre-existing species. The cause of freedom has not more completely conquered in the intervening time than has the cause of evolution. The names of Gray and Agassiz will ever stand in our history as typical of the opposing ideas on this question, as those of Grant and Davis will of the ideas that divided the North and South. What more striking illustration of the completeness of the revolution than that Gray should have succeeded to the place of Agassiz as one of the regents of the Smithsonian Institution!

Gray was almost alone at first in meeting the skepticism and opposition to Darwinism in this country, and no one who is not familiar with his writings can form an idea of the great service he rendered to sound science and true religion by the clear and conservative nature of his advocacy. Yet throughout the long-continued and good-natured correspondence between Gray and Darwin one most marked difference is observable between the two men. Darwin, in the beginning, was more of a theist than at the close of his life, and his work in evolution may be said to have rendered his views more and more materialistic. Gray, on the other hand, always believed that variation in its grander movements, if not in its details, was guided by some power to an ordered and definite result. He was, in fact, one of the greatest advocates of design, and saw in evolution only greater reason for believing in an intelligent cause. To use his own oft-quoted words, he was "scientifically, and in his own fashion, a Darwinian; philosophically a convinced theist, and religiously an ac-

ceptor of the creed commonly known as the Nicene as the exponent of the Christian faith." Every one in my hearing will understand how this expression of faith is perfectly consistent with firm belief in Darwinism and evolution. Yet the manner in which it can be contorted to suit bias in the opposite direction is very well illustrated by the fact that in a recent necrological notice the editor of a French Canadian magazine asserts that Gray never accepted Darwinism and effectively opposed it.

Some of us are so constituted, mentally, that we with difficulty realize in what we see most manifest in the world—in the misery, suffering and misfortune of individuals—with Pope, that

> "All nature is but art unknown to thee;
> All chance, direction, which thou canst not see;
> All discord, harmony not understood;
> All partial evil, universal good!"

Darwin's nose, as he tells us, very nearly lost him the chance of a voyage around the world on H. M. S. Beagle, and in discussing the question of design he asked Sir Charles Lyell whether the latter believed that the shape of his (Darwin's) nose had been designed. We may well ask whether there is any heart behind this whirling matter in which brute force seems to prevail. Yet Gray so ably expounded evolutionary teleology that his writings will win over many converts to his views. The inherent unity in nature is manifest; all life seems to be held in one great bond, and the idea of God is strengthened rather than imperiled, because we have a satisfactory conception of His mode of working. The intellect demands truth, but the heart cries for love. Science may proclaim that "God is truth," but religion ever answers "God is love." The mystery of life—of causation—is as great as ever, and none the less hidden because of what little light is shed for us upon the covering. We are profoundly in the dark regarding some of its simplest ways and manifestations. There are few of us who have not been at times weighed down and awed with the sense of an undefined and indefinable presence in nature, and whether we conceive the creative spirit as an all-pervading, interpenetrating presence ever with us and ever at work in His own way, or as some grand controlling engineer who has in the past created and ordained that all things shall work to an ultimate end, there is something alluring in the

idea of design, and, as an article of faith, something sublime.

In contemplating these questions I confess to have been profoundly influenced by Gray's writings, but also to having felt the want of a medium whereby design may be conceived to have operated in the past and may yet be seen to operate. The medium must necessarily be psychic, and, while admitting all logical causes which have been brought forward by evolutionists to explain variation, and fully realizing that natural selection only takes advantage of such variation, I yet believe that there is one influence at work—none the less potent because so subtle, and none the less real because so generally denied—which gives us a tangible theory of design. I allude to the mental impressions—the power of the emotions—of the pregnant mother on her offspring, in inducing either direct modification both psychic and physical, or the tendency thereto, especially under stress or where the necessity to conform to new conditions or environment is great, and the requirements and, as a consequence, the emotions are correspondingly great and exceptional. As a cause of variation this was rejected by Darwin, and the influence is usually denied by medical men on physiological grounds; but we are yet profoundly ignorant of some of the most important functions of both mind and body, and if the fact of such influence can once be established, its bearing on evolution as a prime cause, through impulses from within, of modification that may be guided and directed by an all-pervading mind must be admitted, especially among higher organisms where mind is most developed. Who can safely assert that the fact of such influence is not or will not be established? I have for some time been collecting authoritative data on the subject, and firmly believe, from the evidence, in the power of mind in inducing material modification under the circumstances indicated, and I allude to the matter in this connection because I had occasion to suggest it to Dr. Gray, at Manchester, as a working hypothesis to explain the method of design as affecting animals, and because I was pleased to find him by no means unfavorably inclined to the idea.

Beyond the wonted limit of man's age
He lived, a type of usefulness and peace;
His value growing, with his years increase,
To shed a lustre on our history's page.
Honor was his, and worth excelled by none;
And tempered seemed his being and his powers
By all the sweetness of his loved flowers,

And hers who, for so long, beside him shone,
True-hearted, and may fitly share the wreath
Of fame that crowns him. Health, achievement, love;
These blessed his life, and on his soul serene
(As vouching their continuance after death)
Forever rested, like a brooding dove,
The promise of the gentle Nazarene!

Washington, D. C.

Notes on North American willows. II.

M. S. BEBB.

(WITH PLATE X.)

Salix phylicoides And.—A willow, known of late years as by no means rare in Alaska and on the adjacent shores of Eastern Siberia, was first described by Andersson in his preliminary Synopsis of North American Willows, under the above name, given in allusion to the manifest resemblance which the species bears to S. phylicifolia. Subsequently, the same author divided Seeman's specimens, upon which exclusively the species was founded, making of all those which exhibited normally developed aments a second new species, S. fulcrata, and retaining the original name, S. phylicoides, for a single gathering of a bare half-dozen specimens, all told, made by Seeman at "Awatschka Bay, August, 1848." These, evidently taken from the same plant, present the anomaly, very noticeable in an arctic willow, of aments accompanying full-grown leaves. Prof. Andersson did not overlook the abnormal character of this retarded inflorescence, and it is, therefore, all the more surprising that he failed to appreciate the significance of the fact that most of the capsules are empty and that the few which do contain a little pappus produce no seeds. The diminutive size, to which an exaggerated importance is given in the description, is simply due to non-fertilization! If proof were needed of this I might cite a specimen in the Gray herbarium which, along with the "rectangularly veined" lanceolate-acuminate leaves of the Prodromus S. phylicoides, bears one imperfectly fertilized ament, capsules as in Seeman's Awatschka Bay plant and another fully fertilized ament with capsules 2-3 lines long—leaves and fruit of S. phylicoides, and on the same twig an ament of S. fulcrata!

The species varies much in stature and habit. On the southern shores of Alaska it is apparently a stout bush with

BEBB on SALIX PHYLICOIDES AND.

erect branches from a decumbent trunk. On the northern shore—Point Barrow, etc.—it is a small prostrate shrub, spreading over two or three feet, but keeping close to the surface of the ground. The leaves vary in outline from lanceolate to elliptic, entire or obscurely serrulate, the aments from oblong to narrowly cylindrical with or without bracts, no one of these characters being constantly associated with any peculiar veining of the leaves.

The long linear-lanceolate stipules constitute a distinguishing feature, and, clinging to the stems as they do for two or three years, often render possible the identification of staminate aments unaccompanied by leaves.

Without understanding the shifting about which Seeman's specimens received in Andersson's hands, the student is likely to be mystified by the inconsistencies of the three consecutive descriptions given. For instance, we have, first, in the Salices Boreali-Americanæ "capsulæ 2-3 lineas longæ;" next in the Monographia Salicum "capsulæ lineam longæ;" and finally in De Candolle's Prodromus "capsulæ semi-lineam longæ." From three lines to half a line and not a word to indicate that the phylicoides of the final description is other than the phylicoides of the first! Nay, in the final description reference is directly made to the original publication in the Sal. Bor.-Amer., while on the opposite page under S. fulcrata we read: "*Huc forsam etiam pertinet S. phylicoides, Anders. Sal. Bor.-Amer.*" Happily, we now know, if Prof. Andersson did not, that all this confusion falls within the limits of a single species for which S. phylicoides is the oldest name; happily, too, the original description recognizes only the normal character of the species and altogether ignores the imperfect development exhibited by a few chance specimens.

Rockford, Ill.

Explanation of Plate X.—Figs. 1-7. Seeman's plant, "N. W. America," type of S. phylicoides and afterwards of S. fulcrata, from fragments given me by Sir Joseph D. Hooker, accompanied by tracings and sketches by Prof. Oliver; 1, 2, leaves; 3, capsules ×6; 4, ament; 5, stipule ×3; 6, scale ×6; 7, emarginate stigmas ×6.

Figs. 8-10. Plant coll. McKay, Nushajak, Alaska; 8, leaves; 9, lower portion of a large ament to show the leafy peduncle; 10, 11, capsules of S. phylicoides And. DC. Prod., abortive, from Seeman's Awatschka Bay plant!

Figs. 12-15. Coll. Harrington, Nagai Island, Shumagins (Herb. Gray); 12, leaf showing "rectangular veining;" 13, capsule normally developed ×6; 14, capsule from the same plant, abortive (like the Prodromus S. phylicoides ×6); 15, stipule ×3.

Undescribed plants from Guatemala. IV.

JOHN DONNELL SMITH.

(WITH PLATE XI.)

Gonzalea thyrsoidea.—Pilose: leaves except veins glabrate, oblong (8-9 inches), each end acuminate, shortly petioled: thyrsus virgate, a foot long; flowers 3-7, pedicellate, in scattered nearly sessile cymose clusters: calyx-tube produced; teeth smooth, colored, small, triangular, unequal: corolla-tube cylindrical, 7 lines long; lobes nearly half as long, of a darker red, farinaceous and arachnoid within, their contact in æstivation alternately imbricate and induplicate-valvate: anthers barely included: style scarcely attaining to their base; divisions of stigma 4, linear: disk radiately 8-lobuled: ovary 4-locular.—Mountains of Pansamalá, Dept. Alta Verapaz, alt. 3,800 feet, May, 1887. (Ex Plantis Guatemalensibus Tuerckheimianis, quas edidit John Donnell Smith, 1249.)

Mikania pyramidata.—High-climbing shrub with ferruginous-hirsute branches, petioles and inflorescence: leaves pubescent, more scabrid above, ovate-lanceolate, slenderly acuminate, 4-8 inches long, base truncate or rounded, margin with an angulate tooth and distant callose points, nerves from base in 2-3 remote pairs: panicles pyramidal, compound, densely flowered, 6-12 inches long; branches brachiate, leafy-bracted below, the upper alternate; heads loosely corymbose, pedicels equaling involucre; its bracts glabrate, linear-oblong (2 lines), apex obtusish and pubescent, subtending bract shorter and lanceolate or none: corolla equaling involucre; limb campanulate, exceeding slender tube, cleft to middle in ovate-lanceolate lobes: akenes nearly smooth, a little exceeded by involucre and sordid-white pappus.—Forest near Coban, Dept. Alta Verapaz, alt. 4,300 feet. January, 1887. (Ex Pl. cit. 1106.)

Zexmenia Guatemalensis. — Fruticose, scabrid, cano-pilose: leaves muricate-scabrous above, hairy beneath, tripli-nerved, mucronately denticulate, ovate-lanceolate, 4-6 inches long, spatulately narrowed to dilated connate base: peduncles cano-lanate, 3-5, subumbellate at apex of branches, exceeded by subtending leaves; heads hemispherical, 5 lines high; exterior bracts of biserial involucre 5, herbaceous, a third longer than the 8 inferior: rays 8, bidentate, 6 lines long:

disk-corollas a little exceeding involucre, equaling produced rigid tips of lacerate chaff, limb exceeding tube, lobes cano-hirsute: ray-akenes obovate; pappus-teeth confluent with wings, incurved-lanceolate, shortly-awned, connate, the lateral equaling corolla-tube: disk-akenes oblong-turbinate, subtriquetrous, costate, puncteolate; pappus a squamellate cup, exaristate or occasionally 1-awned.—Coban, alt. 4,300 feet, February, 1886. (Ex Pl. cit. 853.)

Encelia pleistocephala.—Branches angulate, purplish, pubescent toward inflorescence: leaves alternate, scabrid above, pubescent beneath, penninerved, callose-denticulate, oblong-lanceolate, 5-6 inches long, acuminately narrowing to a channeled petiole an inch long: corymbs compound, dense, a little surpassing leaves; heads long-pedicellate, 6 lines high; involucre half as long, campanulate, purplish-green, pubescent, 2-3-serial, inner bracts oblong, outer smaller and thick: rays 5-6, oval, 2 lines long, 3-denticulate, yellow, tube equaling involucre; disk-corollas equaling rays, exceeding concave pubescent chaff, lobes darker yellow: anthers black, barely exserted: akenes spatulate, nerved, nearly smooth, margins ciliolate; awns from inner side of conspicuous teeth, upwardly barbellate, equaling corolla: abortive akenes occasionally triquetrous, unequally 2-3-aristate.—The anomalous inflorescence recalls several *Verbesinæ;* but technically distinct by neutral rays.—Rocks near Coban, alt. 4,300 feet, February, 1887. (Ex Pl. cit. 1121.)

Gonolobus velutinus Schlecht., var. **calycinus.** — Indument pilose, uniform throughout of young leaves and follicles dense: leaves caudate-acuminate, hairs of upper surface from muriculate points: calyx-lobes nearly equaling corolla, roundish with caudiculate barbate apex, otherwise nearly smooth.—In 2458 *Bourgeau*, cited by Hemsl., *Biol. Centr. Am.*, leaves are as in description velutinous, calyx-lobes smaller and not produced.—Pansamalá forest, alt. 4,000 feet, April, 1887. (Ex Pl. cit. 1124.)

Lamourouxia integerrima (§ *Hemispadon* Benth.).—Leaves entire, lanceolate, 16-20 lines long, a fourth as broad: flowers somewhat crowded toward summit of branches: calyx faintly 8-nerved; tube 2 lines long, equaling peduncle, exceeding triangular erect bilabiately unequal teeth: corolla ventricose, 15-17 lines long, 4-5 lines wide at throat, cleft less than half way; posterior lip retuse, rectangular: anantherous stamens half as long as the fertile.—The nearly related *L. lanceolata* Benth., also collected by Mr. von Türck-

heim, similar in habit, differs by slender serrate leaves, more scattered longer-peduncled flowers, 12-costate calyx with long-spreading nearly equal marginate lobes, straight narrow more deeply cleft corolla, its posterior lip entire with produced angles, longer sterile stamens.—Pansamalá, alt. 4,000 feet, January, 1887. (Ex Pl. cit. 1112.)

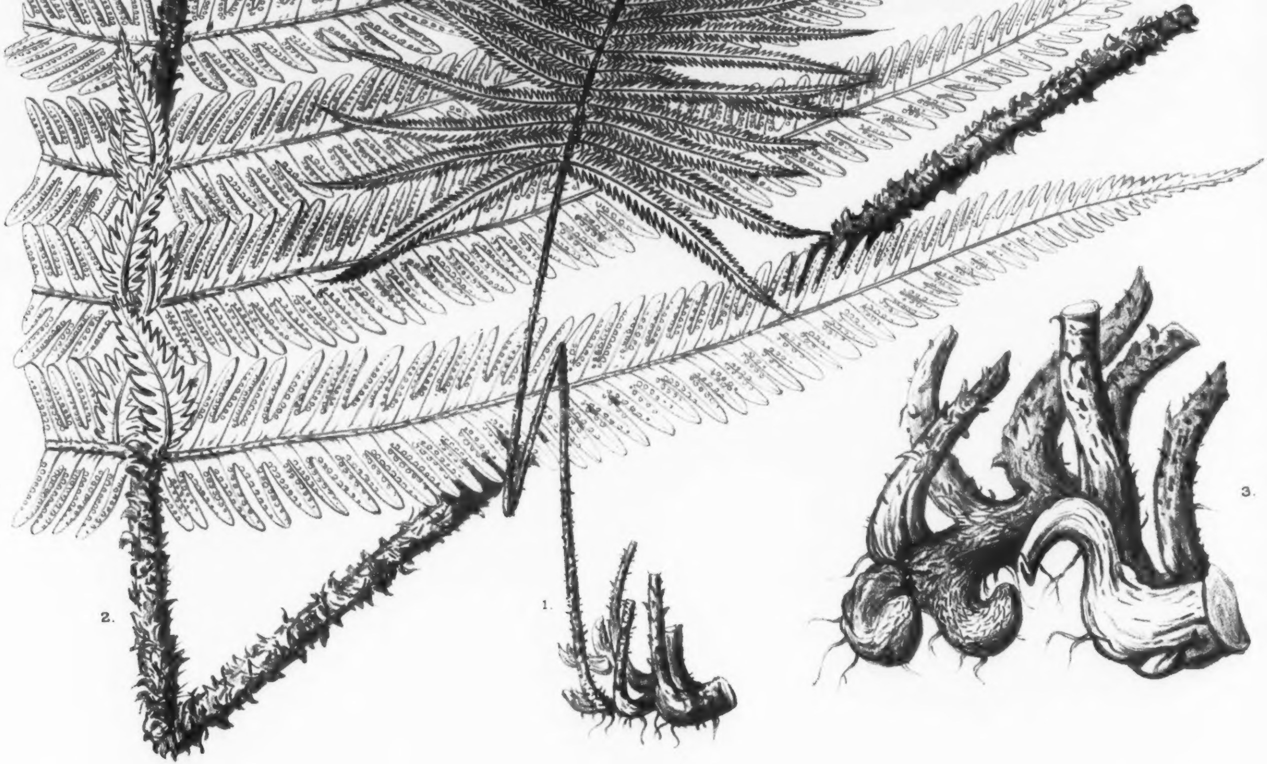
Pitcairnia Tuerckheimii (§ *Eupitcairnia* Baker).—Acaulescent: basal bracts lanceolate, attenuately prolonged, retrorsely prickly, 12-18 lines long, passing into similar unarmed basal leaves; those of peduncle cano-floccose beneath, linear-attenuate, erect, the lower 6-8 inches long by 4-5 lines broad: peduncle a foot or more long, like triangular rhachis araneose; raceme 8-14-flowered, internodes of about an inch; bracts ovate-lanceolate to ovate, 7-4 lines long, equaling smooth erecto-patent pedicels: sepals like bracts uncolored, glabrous, linear-tapering, acute, 12-14 lines long, scarcely 1½ lines broad: petals nearly 3 inches long, crimson, paler below, basal scales absent: anthers protruding: style exceeding petals.—Rock-crevices, Santa Rosa, Dept. Baja Verapaz, alt. 5,000 feet, July, 1887. (Ex Pl. cit. 1298.)

Nephrodium Tuerckheimii. BOT. GAZETTE, xii, 133.—Explanation of Plate XI: Fig. 1. Frond reduced. Fig. 2. Portion of base of frond: nat. size. Fig. 3. Rootstock: nat. size. Fig. 4. Base of a lower pinna: nat. size. Fig. 5. Two segments of a pinna: enlarged. Fig. 6. Portion of a segment: more enlarged. Fig. 7. Indusium: magnified. Fig. 8. Scale from stipe: magnified.

An apparently undescribed species from Costa Rica is here added. It is numbered 176 of a small collection made by Señ. Juan J. Cooper, near Cartago, alt. 4,500 feet, December, 1887.

Zanthoxylum Costaricense.—Branches flexuose, armed with compressed recurved spines, glabrous, blotched with black exudations: petioles canaliculate, 6-9 lines long; leaflets 3, terminal exceeding others, oblong (21-26 lines), apex acuminate and retuse, base acute, crenulate, punctate throughout: panicles axillary and terminal, scaly-bracteoled, verrucose; in fruit ramified, an inch or more long, from leafless nodes: flowers not seen: cocules 1-2, globose, glandular-tuberculate, dehiscing to base, stipe and gynophore each about half a line long; seed globose.—A shrub 10-15 feet high, known as "Limoncillo."

Baltimore, Md.



C. E. Faxon del. B. Meisel, Lith Boston

NEPHRODIUM TUERCKHEIMII, J. Donnell Smith.

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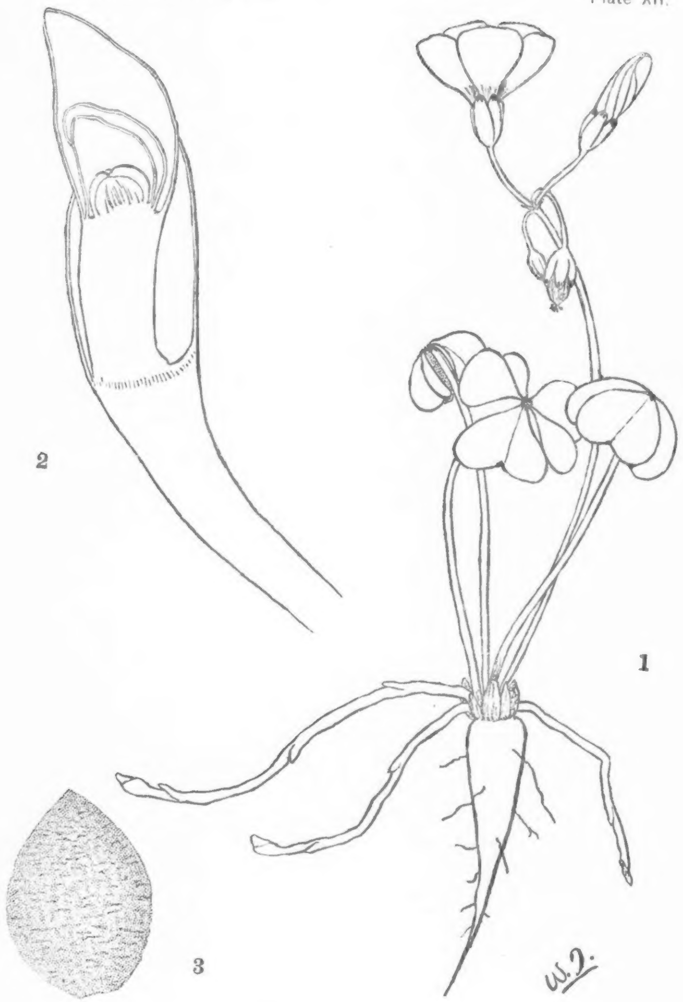


TRELEASE on OXALIS.

BRIEFER ARTICLES.

The subterranean shoots of Oxalis violacea (WITH PLATE XII).—Though one of the commonest plants in the prairie states the violet wood-sorrel is usually gathered so early in the season that several interesting features are not commonly represented in herbaria. While enjoying a few days in looking at the rich flora about Mount Carmel, Ill., in company with Dr. Schneck, a fortnight since, I succeeded for the first time in getting specimens of this species, with the subterranean bulbiferous shoots that are characteristic of the section to which it belongs; and the subsequent collection of a fine lot of plants in the same condition near St. Louis by Mr. Pammel enables me to figure the plant for the GAZETTE.

In the specimens collected the watery tap-root, which is represented in occasional herbarium specimens, but is not very often collected, although it is a normal part of the plant from this time on, was finely developed, in some instances reaching a length of two inches and a diameter of over half an inch. From the withered bulb just above this protruded three to nine fleshy white runners one or two millimeters in diameter, and in some cases considerably over two inches long, remotely scaly below, the rather acute apex somewhat enlarged, and with crowded scales, the inner very thick and yellow, forming the young bulb of next season. The runners appear to curve downward at first, afterward bending upward at the apex.

References to the literature of the subject, especially with respect to other species, are given in my biological notes on the genus (*Memoirs Boston Soc. Nat. Hist.* iv, 92). WILLIAM TRELEASE, *St. Louis, Mo.*

EXPLANATION OF PLATE XII.—*Oxalis Violacea* L. 1. Short-styled plant, showing the watery tap root and bulbiferous shoots, natural size. 2. Longitudinal section through the end of a runner, × 10. 3. Seed, × 30.

Diervilla rivularis, n. sp.—Shrub two to five feet high; whole plant hirsutely pubescent: branchlets nearly terete: leaves subsessile, ovate or oblong-lanceolate, acuminate, unequally and obtusely serrulate, pale beneath: flowers lemon yellow, larger than those of D. sessilifolia, in three to six or more axillary cymes, these often floriferous: calyx-lobes lanceolate-subulate, about as long as the attenuate neck of the carpel: corolla slightly bilabiate.—First collected in flower July 6, 1880, on the banks of "Lula Falls," Lookout Mountain, a few miles across the Tennessee line in Georgia. It grows close to the water's edge. I have received this spring from Kelsey brothers, Highlands, N. C., the genuine *D. sessilifolia* Buckl., which now flowers in my garden; but it is glabrous throughout, with smaller, more regular flowers, which are sulphur or greenish yellow. D. rivularis is a handsomer plant.—A. GATTINGER, M. D., *Nashville, Tenn.*

EDITORIAL.

THERE ARE many botanists who are in no position to do conspicuous work, and it is perhaps fortunate for botany that this is true. It is certain, at least, that the opportunity of doing good work in a very conspicuous way does not always reflect great credit upon the worker. At the same time, these botanists are desirous of doing some sort of work, and of not doing it at random. There is work and work in botany, and much of it is like moving a pile of bricks back and forth from one side of a field to the other; it may be good exercise, but a dreadfully uninspiring result. It is like teaching a class to do nothing but name plants, which one of our bright botanists says is like chasing a woodchuck into a hole—one has nothing to show for it but the hole. All botanical work should mean something; should be some little contribution toward a better knowledge of botany. There is a very hopeful field of work that can be cultivated by these isolated botanists who are desirous of doing something of value, especially hopeful because it is so exhaustless. Systematic botany will never reach its highest expression until there is complete knowledge of the minute as well as the gross anatomy of all groups of plants. So little is our knowledge, comparatively speaking, of this extensive field, that no generalizations can yet be attempted, and every good worker with a microscope can easily become a contributor. The work will have to be done in this piecemeal way by very many investigators, and no one need fear that this sort of work will soon "run out." Two closely allied groups of plants would form a fine subject for any one's investigation as to their comparative anatomy. It is hardly necessary to say that we do not refer to the casual comparison of a few sections, but to that patient, laborious, "over-and-over" study of every tissue which alone will bring permanent results. This is suggested as one field of work among many, especially convenient to those who are fond of using the microscope, and possibly useful in saving them from that aimless frittering away of strength which is too apt to be the fate of the owner of a microscope.

OPEN LETTERS.

Michigan Forestry Commission.

Michigan has long been prominent for the large amount of its timber. The rapid disappearance of this by cutting and fires has caused some to begin to study the subject with reference to legislation. Instead of enacting laws hastily last winter, the Legislature made the State Board of Agriculture a forestry commission, with $1,000 at their disposal. Hon. C. W. Garfield and the writer are the directors of this commission. We are to make investigations and report to the Governor, with recommendations as to any needed legislation. In studying the subject it is

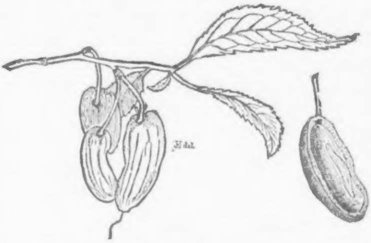
thought very desirable to select three to six townships of land, which shall be held as a forest reserve. Here nature should take possession; the woody plants and herbs and the harmless game should be protected.

In the recently established experiment station of the Agricultural College some attention is to be given to the "jack-pine" lands, or pine plains, where Pinus Banksiana is the leading tree. The authorities have stations already started in five counties, viz.: Lake, Clare, Iasco, Crawford and Grand Traverse. Here the pine plains land is to be tested with grasses, other forage plants and forest trees. W. J. BEAL.

Agricultural College, Mich.

Diseased plums.

The accompanying drawing (half natural size) represents an abnormal growth of the plum (Prunus Americana), produced in consequence of the attack of a fungus. The ovary has been swollen into an inflated sac, with thick and spongy walls, and occasionally contains an elongated body, apparently the aborted ovule. The fungus causing the abnormality is known as Ascomyces Pruni, or Exoascus Pruni, or Taphrina Pruni. The reproductive bodies appear as a white powdery substance on the outside of the swollen sac. Has this species been recorded in this country before now?



Oxford, Ohio. JOSEPH F. JAMES.

Proterogynous Umbelliferæ.

In the May number of the GAZETTE, p. 134, Prof. Trelease has again started the question of proterogyny in Umbelliferæ.

In 1887 I made a special study of the floral characters and insect visitors of most of the species growing in my neighborhood, and I may give the general result of my observations, although I must refer the reader to a forthcoming paper for my mature views and for the details on which those views rest.

In my opinion Hydrocotyle umbellata (observed at Orlando, Fla.), Eulophus Americanus, Cicuta maculata, Sium cicutæfolium, Osmorhiza longistylis, Pastinaca sativa and Heracleum lanatum are proterandrous.

Sanicula Canadensis, Cryptotænia Canadensis and Chærophyllum procumbeus are synacmic.

Sanicula Marylandica, Erigenia bulbosa, Zizia aurea, Pimpinella integerrima and Polytænia Nuttallii are proterogynous.

Carlinville, Ill. CHARLES ROBERTSON.

CURRENT LITERATURE.

The Entomophthoreæ of the U. S.[1]

Mr. Thaxter has undertaken a study of the entomogenous plants of North America, and presents his first contribution to the subject upon the group named in the title. The paper embodies not only his own observations, but those of American and European botanists. Of the former just three are cited, as against twenty of the latter. After preliminary remarks upon the sources of material and information, and the four other groups of entomogenous plants, the author proceeds to a consideration of the Entomophthoreæ, of which three genera are found in this country—Empusa, Massospora and Basidiobolus. Entomophthora and Triplosporium are considered as sub-genera of Empusa. The morphology and life history of Empusa are thoroughly treated; the various species are described, and figured on exquisite lithograph plates. Twenty-six species are recognized, of which the following sixteen are new: E. apiculata, papillata, Caroliniana, lageniformis, Lampyridarum, geometralis, occidentalis, dipterigena, virescens, Americana, montana, echinospora, sepulchralis, variabilis, rhizospora and gracilis. Arthur's Entomophthora Phytonomi (BOT. GAZ., xi, 14) is referred to Empusa sphærosperma, and Bessey's Entom. Calopteni (*Am. Nat*, xvii, 1280) to Empusa Grylli. The monograph is excellently done, and is worthy of the dress and company in which it appears. Botanists can help Mr. Thaxter by sending material to him at New Haven, Conn.

Contributions to American botany.[2]

Dr. Watson finds that our 33 North American species of Vesicaria are entitled to generic rank, and so he cuts a Gordian knot of difficulties by separating them from the Old World forms under the generic name *Lesquerella*. In this way, Alyssum Lescurii of Gray's Manual becomes Lesquerella Lescurii, which double honor is none too much for the veteran Lesquereux to carry. Vesicaria Shortii of the Manual becomes L. globosa. But most of our Lesquerellas are western and southwestern, and the specific names under Vesicaria are, for the most part, transferred to the new genus.

A revision of Draba is also given, showing 32 species, the only change among the eastern forms being the reduction of D. arabisans to a variety of D. incana.

In addition to these revisions, 27 species new to the United States are described, among which is a new genus of Compositæ (Eupatoriaceæ) from Florida, and described by Dr. Gray under the name *Hartwrightia*.

[1]THAXTER, ROLAND.—The Entomophthoreæ of the United States. Memoir of the Boston Society of Natural History, Vol. iv, No. vi, pp. 131-201, pl. xiv-xxi, 4to. Boston: Published by the Society, April, 1888.

[2]WATSON, SERENO.—Contributions to American Botany, XV. From the Proc. Am. Acad. xxiii, pp. 249-287. [Issued May 29, 1888.]

Among other interesting new plants are an Ivesia and a Pyrus from the Pacific coast, and a new Tillandsia from Florida.

The second section of the contribution contains descriptions of new species of Mexican plants, chiefly of Pringle's collection in the mountains of Chihuahua in 1887. There are 55 species described, and among them a new genus of Umbelliferæ, *Prionosciadium*, starts out with three species, one of them being the Angelica Mexicana of Pringle's distribution.

The contribution closes with descriptions of eight new plants of Guatemala, one of which is the type of a new genus of Acanthaceæ, *Louteridium* by name.

NOTES AND NEWS.

REV. THOMAS MORONG sailed for Buenos Ayres about the middle of July.

PROF. DUDLEY, of Cornell University, returns from his year abroad about the first of October.

MR. J. N. ROSE, of Wabash College, has been appointed one of Dr. Vasey's assistants at the Department of Agriculture.

MR. F. V. COVILLE, of Cornell University, has been appointed one of Dr. Vasey's assistants at the Department of Agriculture.

DR. DOUGLASS H. CAMPBELL and Dr. Winthrop E. Stone return from Germany in August with the honors of recent doctorates.

DR. W. TRELEASE is spending two months or so at the laboratory of Dr. Koch, in Berlin, carrying on special bacteriological studies.

MR. ERWIN F. SMITH will continue his investigations of "peach yellows" this summer in the orchards of Maryland and Delaware.

PROF. SUSAN M. HALLOWELL, of Wellesley College, having completed her studies in foreign laboratories, returns to America shortly.

ON ACCOUNT of the change to an earlier date for the meeting of the A. A. A. S. Prof. Arthur will not return from Europe in time to attend, but expects to be back by the first of September.

THE SUMMER SCHOOL at Cambridge this year is largely attended. With such a lecturer as Dr. Goodale, and such apparatus as is to be had at Harvard, all surrounded by the botanic garden, it is a wonder that the summer school is not overcrowded.

REV. DR. W. H. DALLINGER has resigned the principalship of Wesley College, at Sheffield, England, and will remove to London, where he intends to fit up a private laboratory and pursue his bacteriological and other studies free from interruption.

AN APPRECIATIVE SKETCH (with portrait) of Dr. Asa Gray, by James Britten, appears in the *Journal of Botany* (June). The portrait does him scant justice, and it is a fortunate thing that most foreign botanists do not have to depend upon it for their knowledge of his personal appearance.

ALTHOUGH several of our botanists are in Europe this summer, there are enough at home to make the Cleveland meeting a great success. The date of meeting has been fixed a week earlier, being August 15. Botanists should all arrange to attend, as personal acquaintance with their fellows is of incalculable benefit.

THE ELECTION of Dr. Sidney H. Vines, F. R. S., Lecturer in Botany at Cambridge, to succeed Prof. Balfour at Oxford, gives general satisfaction in English botanical circles, and not only secures an important acquisition to Oxford, but is a high compliment to Dr. Vines, who was without a competitor for the position.

THE ORIGIN of the tubercles on leguminous roots has given rise to much discussion, the opinion varying between their being normal structures or diseased structures. Dr. Farlow gives a short *resumé* of the subject in *Garden and Forest* (May 16), calling attention to the difficulty of the subject, and also stating that it can be safely said that they are not normal structures.

THE BLACK SPOT, a disease of roses, is treated in the *American Florist* for May 1 by W. S. Windle, a senior student of Purdue University. He describes and illustrates the fungus, Actinonema Rosæ, which causes the disease, and points out that the discoloration of the leaf is due to the gradual filling up of the outer epidermal cells with a dark mass, deposited as a result of the presence of the fungus.

THE BOTANISTS will be well cared for at Cleveland. The Hollenden will be the headquarters of the Botanical Club. Meetings will be held each morning at 9 o'clock. Excursions will be made Friday afternoon and Saturday, and everything that President Day or Secretary Spalding can secure for their pleasure and profit may be expected. There should be a liberal response in attendance and notes.

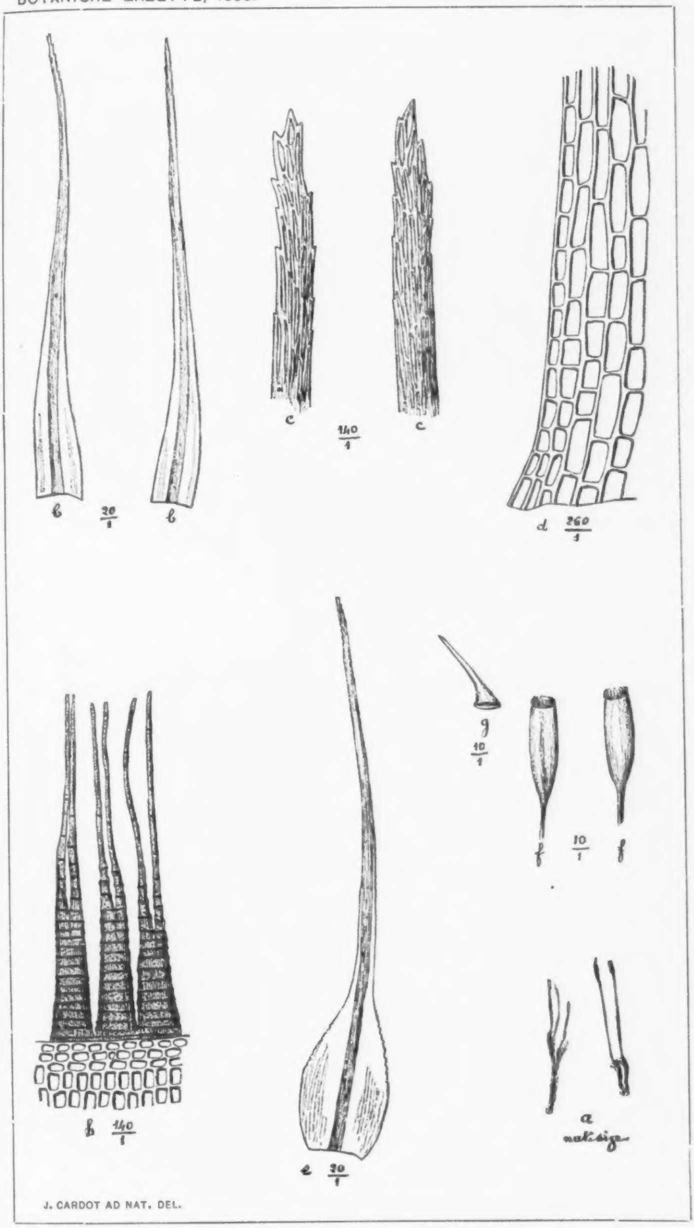
ALGÆ living upon animals as parasites is a curious subject lately investigated by Mme. A. Weber van Bosse. Several species are described belonging to the genera Trichophilus and Cyanoderma, which infest the hairs of sloths. The damp, shady, tropical forests which form the home of these sluggish animals seems to be sufficient explanation, as pointed out by Dr. Farlow in *Garden and Forest* (April 25).

MIMICRY among plants was recently discussed by Dr. J. T. Rothrock before the Philadelphia Academy. He arranges mimicry under two heads: (1) that found between plants of distinct groups; (2) that found between plants of the same family. In the former case the lower type may be considered an anticipatory or prophetic type; in the latter it seems to indicate a common descent within a recent period.

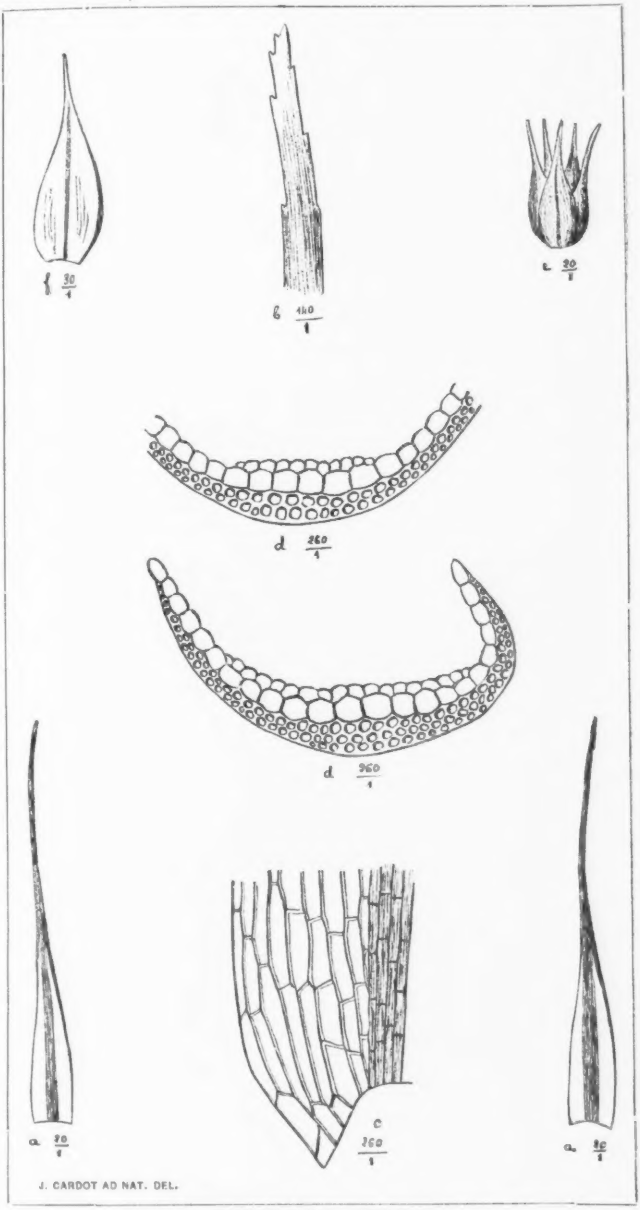
PROF. L. H. BAILEY, JR., will go abroad in August. He will visit the leading experiment stations and horticultural establishments, and also spend considerable time in studying the originals of cultivated plants at the great herbaria of Kew and on the continent. The Carices will incidentally come in for some share of attention, and much valuable information is likely to be gathered for the better elucidation of our flora.

PFITZER recommends[1] a modification of the soap-imbedding process for a study of developmental processes. A mixture of equal parts of glycerine and 96 per cent. alcohol is saturated at 60°–70° C. with finely shaved, transparent glycerine-soap. The plant parts taken from strong alcohol are brought into the mixture before it sets by cooling. Or they can be penetrated by allowing them to lie in a similar cold-saturated solution of soap. This imbedding mass keeps without change in corked vessels and becomes fluid at 40° C. The action of the alkali of the soap renders the sections particularly clear.

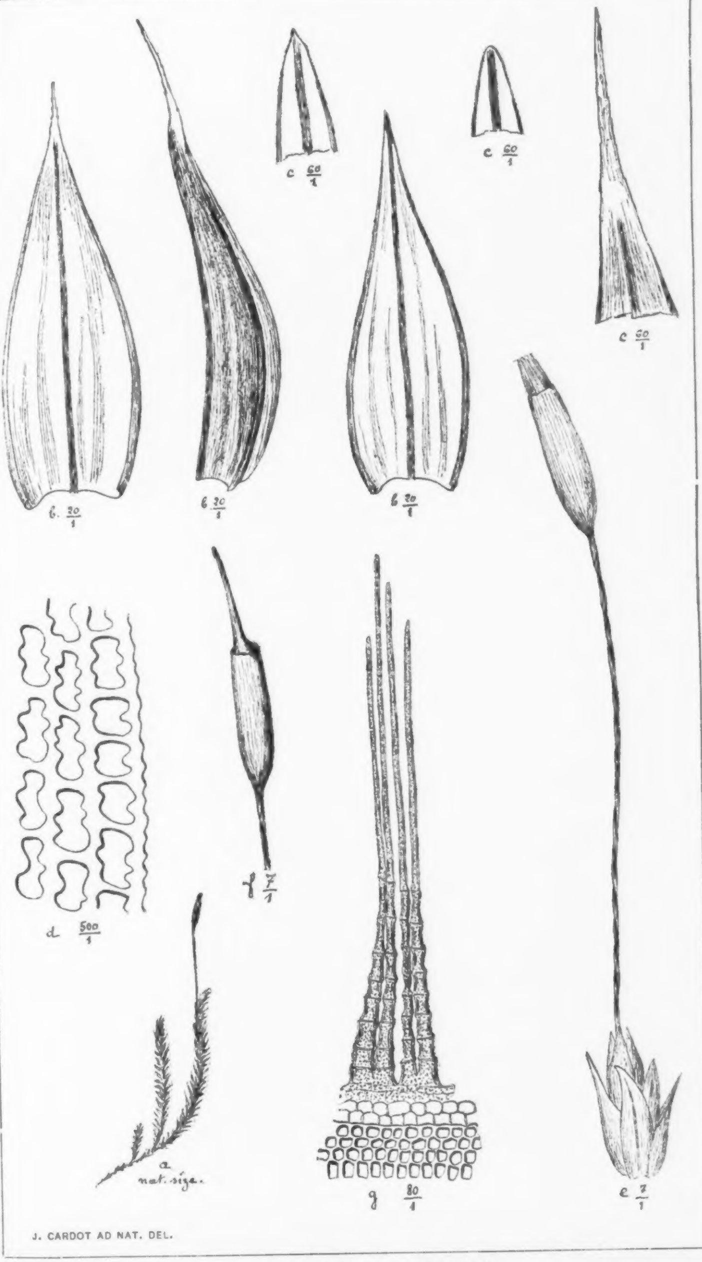
[1] Berichte d. deut. bot. Gesells. V. 1887., p. lxv.



DICRANELLA FITZGERALDI.

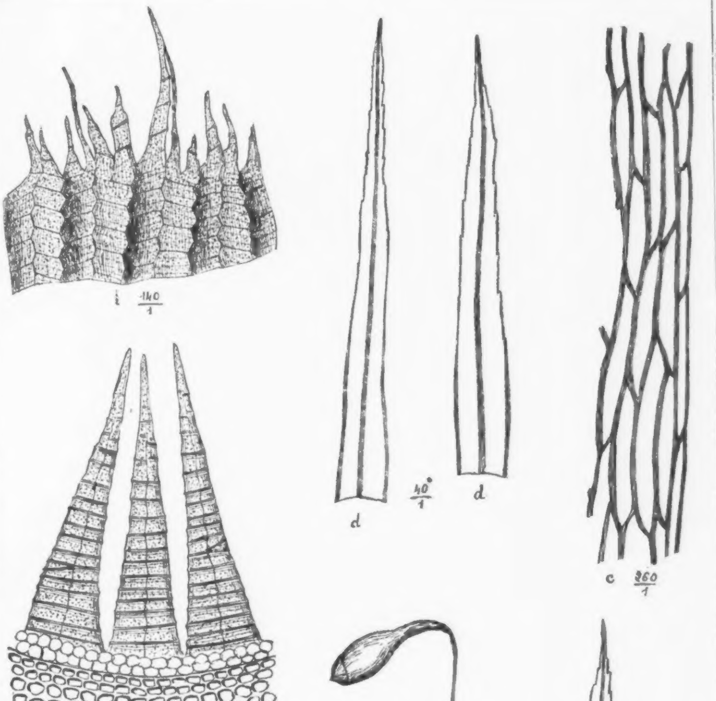


CAMPYLOPUS HENRICI.



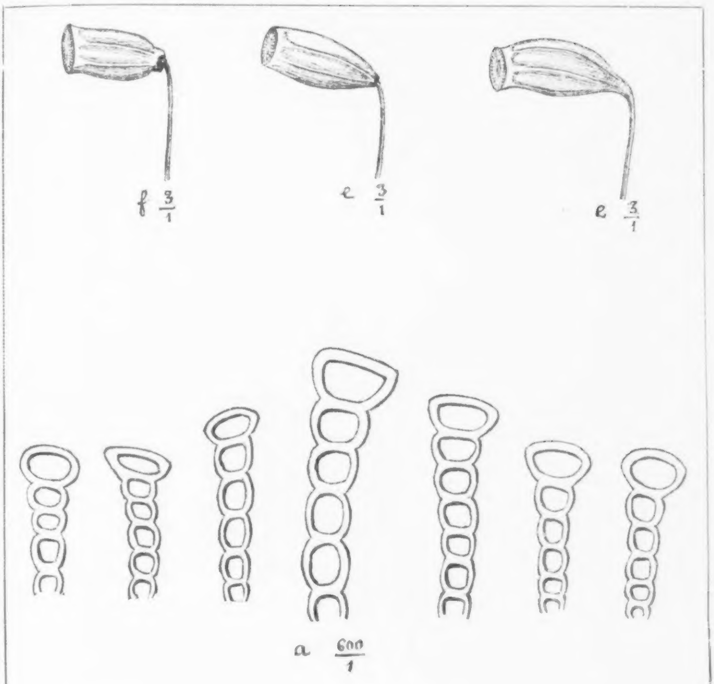
J. CARDOT AD NAT. DEL.

RHACOMITRIUM OREGANUM.

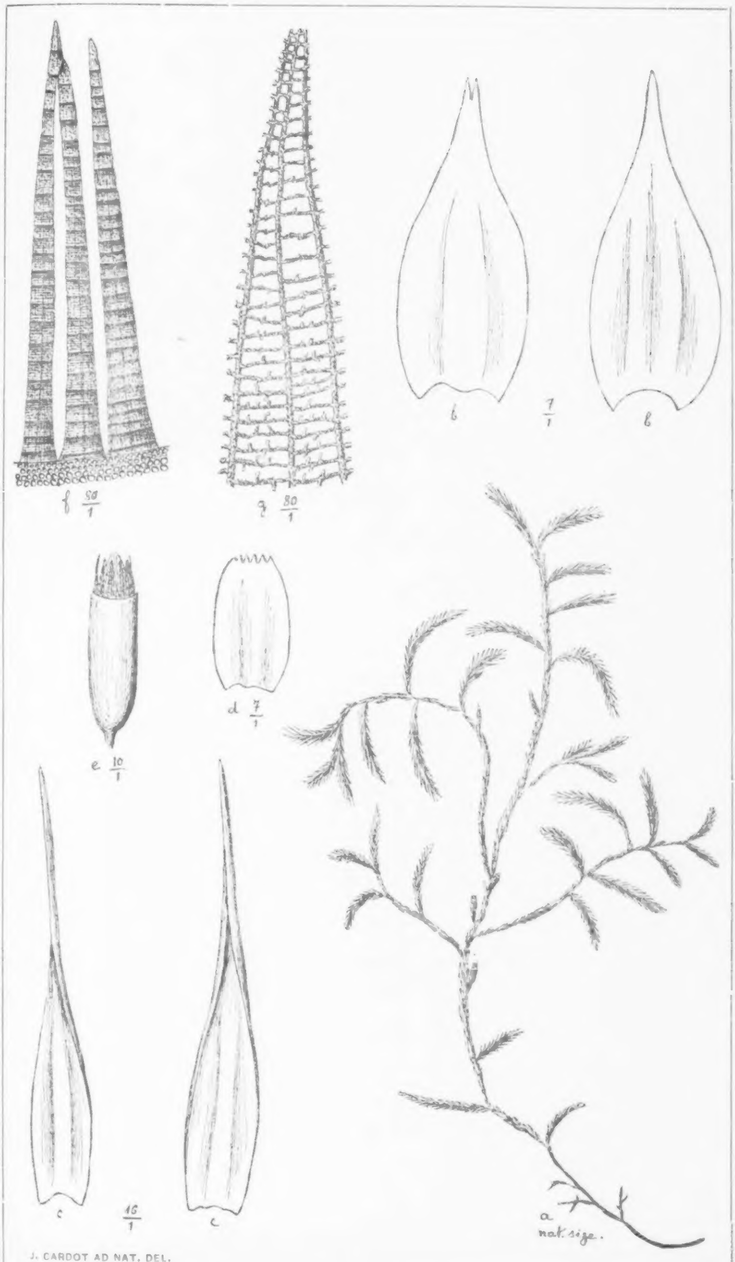


J. CARDOT AD NAT. DEL.

WEBERA CAMPTOTRACHELA.

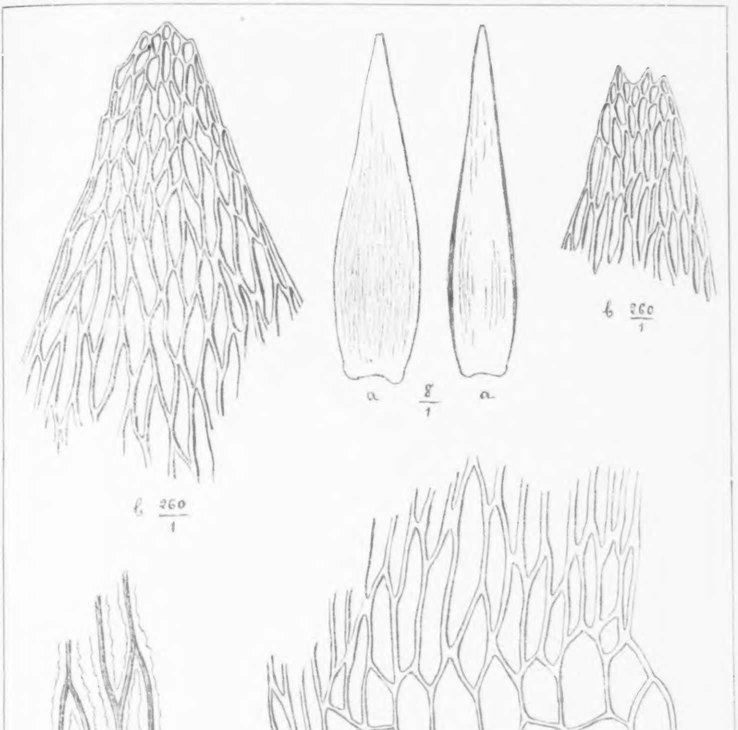


POLYTRICHUM sp.

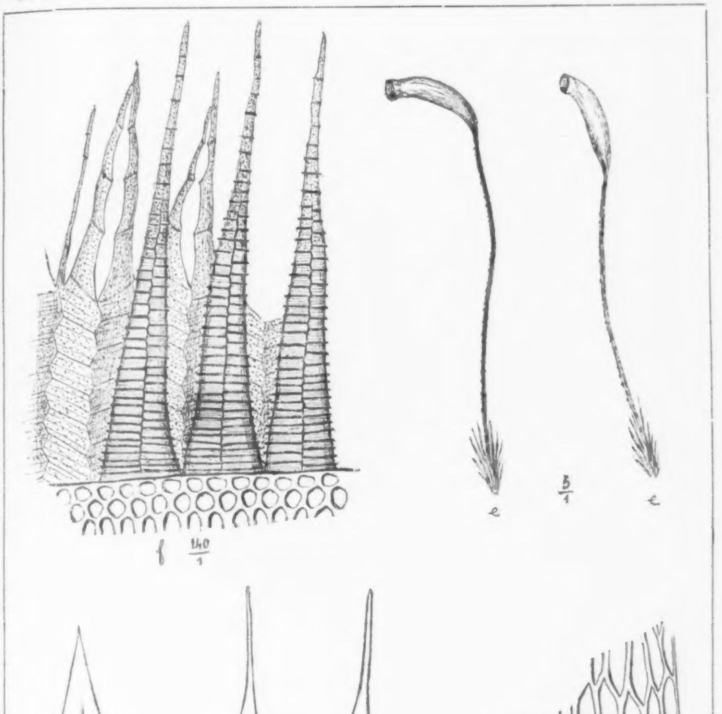


J. CARDOT AD NAT. DEL.

FONTINALIS HOWELLII.



FONTINALIS FLACCIDA.



CAMPTOTHECIUM AMESIÆ.